Document ID: EDF-1543
Revision ID: REV 0
Effective Date: 12/14/00

Engineering Design File 1543

Staging, Storage, Sizing, and Treatment Facility (SSSTF)

Waste Transport Study

[The following statement is optional:
Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho]

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Form 412.14
10/05/99
Rev. 02

ENGINEERING DESIGN FILE

1. Project File No.: 020996 2. Project/Task: SSSTF

3. Subtask: SSSTF Waste Transport Study

4. Title: SSSTF Waste Transport Study

5. Summary:

This Engineering Design File (EDF) has been prepared to address packaging and transportation requirements for shipping Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation wastes from various Idaho National Engineering & Environmental Laboratory (INEEL) Waste Area Group (WAG) sites to the INEEL CERCLA Disposal Facility (ICDF), a centralized disposal facility at Idaho Nuclear Technology and Engineering Center (INTEC). The defined receiving facilities include the following:

- Staging and Storage Annex (SSA). The SSA is located within the INTEC facility, is part of the ICDF Complex, and is used to stage and store CERCLA waste generated from the present until such time as the SSSTF and the ICDF are in operation.
- Storage, Staging, Sizing, and Treatment Facility (SSSTF). The SSSTF will record, stage, and treat, if necessary, the CERCLA waste before disposed directly into the ICDF (see the following subsection for a description of this facility).

The ICDF landfill will be used to dispose of wastes, which can be accepted, based on meeting the ICDF Waste Acceptance Criteria (WAC). It will be an engineered facility meeting DOE Order 435.1, Resource Conservation & Recovery Act (RCRA) Subtitle C, and Toxic Substances Control Act (TSCA) polychlorinated biphenyl (PCB) landfill design and construction requirements. The ICDF will consist of the landfill cells, an evaporation pond, and a leachate collection system. Note that each receiving facility (SSA, SSSTF, evaporation pond, and the ICDF) will each have separate Waste Acceptance Criteria.

CONCLUSION

The purpose of this EDF is to evaluate the methods of efficiently transporting CERCLA remediation wastes from the various INEEL WAG sites to the INEEL ICDF Complex. This EDF includes the decision criteria for selecting the preferred method or methods of transport. Six container types were evaluated:

- 55-gal drums
- 2 × 4 × 8 ft wooden boxes
- 4 × 4 × 8 ft wooden boxes
- Supersacks
- Dump trucks
- Roll-off containers.

Each container type was evaluated against six criteria and ranked from 1 to 10, 10 being the best for the criteria. The six criteria were:

- Worker Radiation Exposure
- Contamination Control

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5. Summary:

- Labor Intensity
- Cost
- Ease of disposal of waste containers
- Staging.

Each container type was then tallied and the highest valued container was considered the best container for the purpose of transportation. With the value of 52, the results, from Table 5, concluded that the roll-off container is the container of choice, with the exception of waste streams CPP-92, 98, and 99, which are already packaged in wooden boxes.

6. Distribution (complete package):
R. L. Davison
Distribution (summary package only):

7. Review (R) and Approval (A) Signatures:
(Minimum reviews and approvals are listed. Additional reviews/approvals may be added.)

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ACRONYMS

AOC	area of contamination
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWID	CERCLA Waste Inventory Database
D&D&D	Deactivation, Decontamination and Dismantlement
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
DOT	U.S. Department of Transportation
EDF	Engineering Design File
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FHWA	Federal Highway Administration
HW	Hazardous Waste
HWMA	Hazardous Waste Management Act
ICDF	INEEL CERCLA Disposal Facility
IDW	Investigative-Derived Waste
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ITD	Idaho Transportation Department
LDR	Land Disposal Restrictions
MLLW	Mixed low-level waste
OU	Operable Unit
PCB	Polychlorinated Biphenyl
PPE	personal protective equipment

RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
SRPA	Snake River Plain Aquifer
SSA	Staging and Storage Annex
SSSTF	Storage, Staging, Sizing, and Treatment Facility
T&FRs	Technical and Functional Requirements
TSCA	Toxic Substance Control Act
WAC	Waste Acceptance Criteria
WAG	Waste Area Group

DEFINITIONS

The following definitions are presented as an aid to reader understanding of technical and scientific terms used within this document.

Facility. Any area within the boundaries of a DOE controlled site that is access-controlled to prevent public access, for example, TRA, INTEC, and TAN (CFA is not a facility).

Hazardous Constituent. A component material that meets the definition of hazardous material.

Hazardous Material. A substance or material, including a hazardous substance (see definition), hazardous waste (see definition), and radioactive material (see definition), which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce and which has been so designated. These materials are listed in the Hazardous Materials Table, 49 CFR 172.101.

Hazardous Substance. For the purposes of transportation, a material, including its mixtures and solutions, that:

- Is listed in the appendix to 49 CFR 172.101
- Is in a quantity of one package which equals or exceeds the Reportable Quantity (RQ) listed in the appendix to 49 CFR 172.101

When a mixture or solution is in a concentration by weight which equals or exceeds the concentrations corresponding to the RQ of the material.

Hazardous Waste. Any material subject to the Hazardous Waste Manifest requirements of the U.S. Environmental Protection Agency as specified in 40 CFR 261.3 (49 CFR 171.8).

Low-Level Waste. Waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct waste (as defined in section 11.e. (2) of the Atomic Energy Act of 1954, as amended), or naturally occurring radioactive material (DOE Order 435.1).

Mixed Waste. Waste, which meets the definition for hazardous waste and radioactive waste. Mixed waste is referred to as either mixed low-level or mixed TRU waste.

Package. Packaging plus its contents presented for transportation.

Packaging. The package minus the contents, 49 CFR 171.8.

Radioactive Material. Any material having a specific activity greater than 70 Bq/gm (0.002 μCi/g), in accordance with 49 CFR 173.403. Also, any non-radioactive material (activity less than 70 Bq/gm) with surface contamination (both fixed and non-fixed/removable) that, when averaged over each 300 cm^3 (46.5 $in.^3$) of all surfaces, is equal to or greater than 0.4 Bq/cm^2 (10^{-6}) $\mu Ci/cm^2$ for all other alpha emitters.

Radioactive Waste. Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, which is of negligible economic value considering costs of recovery.

Receiving Facility. The ICDF Complex

Remediation Wastes. All solid and hazardous wastes, and all media (including groundwater, surface water, soils, and sediments), and debris that contain listed hazardous wastes or that themselves exhibit a hazardous waste characteristic, managed for the purpose of implementing a corrective action requirement under 3008(h). For a given facility, remediation wastes may originate only from within the facility boundary, but may include waste managed in implementing RCRA sections 3004(v) or 3008(h) for releases beyond the facility boundary (40 CFR 260.10).

TSCA Regulated Waste. Under TSCA waste items containing PCBs greater than or equal to 50 ppm will require management as PCB remediation waste. If waste is <50 ppm, the waste does not require management under the TSCA ARARs. Note that soils that are considered to be remediation wastes will be managed "as found." This means that remediation wastes as described in 40 CFR 761.61 shall be managed based in the concentrations at which the PCBs are found. Soils exhibiting levels greater than 50 ppm will be TSCA-regulated. Based on 40 CFR 761.50(b)(3) PCB Remediation Waste.

Waste Container. A receptacle for waste, including any liner or shielding material that is intended to accompany the waste in disposal (DOE Order 435.1).

Waste Package. The waste, waste container, and any absorbent that is intended for disposal as a unit. In the case of surface contaminated, damaged, leaking, or breached waste packages, any overpack shall be considered the waste container, and the original container shall be considered part of the waste (DOE Order 435.1).

Waste Stream. Waste material from comparable generation processes, possessing similar physical, chemical and radiological characteristics, that will be managed by the same TSD methods.

Staging, Storage, Sizing, and Treatment Facility (SSSTF) Waste Transport Study

1. INTRODUCTION

The U.S. Department of Energy Idaho Operations Office (DOE-ID) authorized a remedial design/remedial action (RD/RA) for the Idaho Nuclear Technology and Engineering Center (INTEC) in accordance with the Waste Area Group (WAG) 3, Operable Unit (OU) 3-13 Record of Decision (ROD).[1]

The ROD requires Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation wastes generated within the Idaho National Engineering and Environmental Laboratory (INEEL) boundaries to be removed and disposed of onsite in the INEEL CERCLA Disposal Facility (ICDF). The ICDF, which will be located south of INTEC and adjacent to the existing percolation ponds, will be an onsite, engineered facility, meeting DOE Order 435.1,[2] Resource Conservation and Recovery Act (RCRA) Subtitle C, Toxic Substances Control Act (TSCA) and polychlorinated biphenyl (PCB) landfill design and construction requirements. The ICDF will include the necessary subsystems and support facilities to provide a complete waste disposal system.

The major components of the ICDF are the disposal cells, an evaporation pond, and the Staging, Storage, Sizing, and Treatment Facility (SSSTF). The disposal cells, including a buffer zone, will cover approximately 40 acres, with a disposal capacity of about 510,000 yd^3. Current projections of INEEL-wide CERCLA waste volumes total about 483,800 yd^3. The SSSTF will be designed to provide centralized receiving, inspection, and treatment necessary to stage, store, and treat incoming waste from various INEEL CERCLA remediation sites prior to disposal in the ICDF, or shipment off-site. All SSSTF activities shall take place within the WAG 3 area of contamination (AOC) to allow flexibility in managing the consolidation and remediation of wastes without triggering Land Disposal Restrictions (LDRs) and other RCRA requirements, in accordance with the OU 3-13 ROD. Only low-level, mixed low-level, hazardous, and limited quantities of TSCA wastes will be treated and/or disposed of at the ICDF. Most of the waste will be contaminated soil, but debris and Investigative-Derived Waste (IDW) will also be included in the waste inventory. ICDF leachate, decontamination water, and water from CERCLA well purging, sampling, and well development activities will also be disposed of in the ICDF evaporation pond.

Only INEEL onsite CERCLA wastes meeting the agency approved Waste Acceptance Criteria (WAC) will be accepted at the ICDF. An important objective of the WAC will be to ensure that hazardous substances disposed in the ICDF will not result in exceeding groundwater quality standards in the underlying groundwater aquifer. Acceptance criteria will include restrictions on contaminant concentrations based on groundwater modeling results with the goal of preventing potential future risk to the Snake River Plain Aquifer (SRPA).

1.1 Purpose of EDF

The purpose of this Engineering Design File (EDF) is to evaluate the method(s) of efficiently transporting CERCLA remediation wastes from the various INEEL Waste Area Group (WAG) sites to the ICDF Complex. This EDF includes the decision criteria for selecting the preferred method or methods of transport.

The sections of this EDF are as follows:

- Section 1. The introduction and the assumptions used for the packaging and transport analysis
- Section 2. Potential waste streams to be received at the ICDF Complex
- Section 3. Packaging and the associated regulatory requirements
- Section 4. Transportation evaluation and transport routes
- Section 5. Evaluation of container types and mode of transport vs. waste streams
- Section 6. Recommendation of method(s) of efficiently transporting the waste
- Section 7. Conclusion
- Section 8. References

1.2 Assumptions

Assumptions were developed as a basis to determine the best means of transport and packaging for the CERCLA wastes. The assumptions are as follows:

- Each generating WAG is responsible for the retrieval, interim management of their waste while still at the place of origin, and packaging. Packaging requirements for wastes being shipped to the ICDF will meet the WAC for each specific facility and will be in accordance with the requirements as defined by the Applicable or Relevant and Appropriate Requirements (ARARS) in the ROD, and DOE Orders. These ARARS can be found in the Technical and Functional Requirements (T&FR's).
- Prior to operation of the SSSTF, it is assumed that some of the CERCLA waste will be initially shipped to the Staging and Storage Annex (SSA) for staging until it can be processed at the SSSTF and disposed of at the ICDF or other appropriate facility.
- This EDF will only evaluate the containers for the waste streams that are going to the SSSTF to be stabilized.
- The WAC for each of the receiving facilities within the ICDF Complex will be used to determine the acceptability of wastes and containers at these facilities.

2. WASTE STREAMS

INEEL CERCLA waste streams to be accepted at the ICDF Complex for treatment at the SSSTF and/or disposal in the ICDF landfill will come from all INEEL WAGs. Waste streams will include mainly contaminated soil, soils from removal actions, and stabilized soils. These streams may also include used contaminated personal protective equipment (PPE), unused and unaltered sample material, drill cuttings, analytical and sample preservative residues, sample containers, purge/development water, decontamination fluid, equipment, demolition debris, miscellaneous wastes, solid wastes, and possibly stabilized monoliths. CERCLA waste to be generated at these sites includes investigative-derived waste (IDW). Deactivation, Decontamination and Dismantlement (D&D&D) wastes will be accepted at the ICDF Complex if the D&D&D project is part of a CERCLA remedial or removal action.

The CERCLA wastes generated from INEEL Environmental Restoration (ER) activities will include:

- Hazardous waste (per 40 CFR 261)
- TSCA regulated waste (greater than 50 ppm PCB as found)
- Low-level mixed wastes (hazardous and low-level radiological contaminants)
- Low-level radiological wastes.

Waste projections, volumes, and contaminant concentrations are described in detail in the "Waste Inventory Design Basis," EDF 1540.[3] The necessary information in the EDF was used to develop an estimate of expected wastes to be shipped to the SSA and the SSSTF for storage and treatment and for disposition in the ICDF Complex.

The waste streams to be stabilized at the SSSTF as well as the contaminated media and estimated volumes of each are presented in Table 1. This information will be used to evaluate the various possible containers that can be used to transport the waste.

Table 1. Non-Liquid Stabilization Matrix.

WAG	Release Site	Volume (yd^3)	Contaminated Media	Site Description	Reference
5	ARA-12	1,966	Sandy silty clay with rock pieces	Unlined surface impoundment (370 x 150 ft). Natural depression used to dispose of low-level waste and facility runoff.	Craig Bean (Geotec. Engineer 6-9941); WAG 5 ROD p. 59-63
10	Borax-01	11,110	Significant imported gravel in an area of silty clay soil	Site of leach pond for the boiling water reactor experiment (BORAX). Dimensions: 20 x 90 ft. Feed included: low-level rad liquid, non-rad cooling tower, H2SO4, NaOH, HBO2.	Craig Bean (Geotec. Engineer 6-9941); WAG 10 Track 1 sites: Decision Doc package. DOC ID: 5757 p. 1-5
4	CFA-04	800	Rocky soil with a small percentage of calcine	Shallow unlined surface depression (500 x 150 ft). Basalt outcrops are present. Primary discharged: 100 yd^3 Hg contaminated calcine & liquid effluent from calcine laboratory.	Debbie Wiggins (WAG 4 Project Engineer 6-9989); WAG 4 ROD p. 8-1 to 8-5
3	CPP-92	1,197	Soil (10%>.75") (.75"<40%>.25") (.25"<40%>.75mm) (10%<.75mm)	584 (2 x 4 x 8 ft) boxes + 5 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 85% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		4	Metal	1 (4 x 4 x 8 ft) box [Assumption: Box is 60% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		116	Concrete	40 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 60% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		53	Soil/Asphalt/Concrete	18 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 60% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
3	CPP-98	30	Soil (10%>.75") (.75"<40%>.25") (.25"<40%>.75mm) (10%<.75mm)	17 (2 x 4 x 8 ft) boxes [Assumption: Boxes are 85% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		209	Wood / Nails / Bolts	98 (4 x 4 x 8 ft) box [Assumption: Box is 45% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		7	Metal	2 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 60% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		4	Undetermined	1 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 60% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
3	CPP-99	30	Soil (10%>.75") (.75"<40%>.25") (.25"<40%>.75mm) (10%<.75mm)	15 (2 x 4 x 8 ft) boxes [Assumption: Boxes are 85% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		2	Wood / Nails / Bolts	1 (4 x 4 x 8 ft) box [Assumption: Box is 45% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		11	Metal	5 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 45% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		62	Concrete	29 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 45% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		12	Soil/Asphalt/Concrete	5 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 50% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
		9	Undetermined	4 (4 x 4 x 8 ft) boxes [Assumption: Boxes are 50% full]	Craig Bean (Geotec. Engineer 6-9941); IWTS
5	ARA-25	56	Rubble (concrete, metal, building materials)	Mixed Low-Level Waste (MLLW)	CWID document DOE/ID 10803 p. 4-3 to 4-8
		16		Hazardous Waste (HW)	
1	WRRTF-01	20,070	Silty clay	Four burn pits used for open burning of construction debris. Total Dimensions: 400' x 165'. Covered with 1/2 to 9 feet of clean soil.	Craig Bean (Geotec. Engineer 6-9941); WAG 1 ROD p. 9-1 to 9-8 section II
	Total Volume (yd^3)=	**35,765**			

3. PACKAGING AND CONTAINERIZATION

3.1 Packaging Requirements

It is assumed that all CERCLA waste generated at the INEEL will be accepted at the SSSTF as long as it is packaged appropriately for the waste form and type generated. CERCLA-generated waste materials must be stored and transported in containers that are in good condition, are stored in containers that are compatible with the waste, and meet DOE Order 435.1 (see Reference 2). The DOE orders provide standards for properly packaging hazardous material and hazardous waste and must be followed to determine the proper containers for the management of each waste stream.

3.1.1 Regulatory Requirements

The CERCLA waste to be shipped to the ICDF Complex will be packaged in accordance with packaging and containerization requirements identified as ARARs in the OU 3-13 ROD (see Reference 1), in the Packaging and Transportation Safety DOE Order 460.1A[5] and described in the SSSTF WAC.

WAG CERCLA waste generators will consult with the ICDF Complex operations personnel prior to generation of any new waste being considered for the SSSTF to identify the specific type(s) of containers required. All containers used for waste accumulation must be properly labeled in accordance with both EPA and DOE requirements before delivery to the ICDF Complex. It is the responsibility of each WAG site manager generating waste to ensure that each drum/container is properly marked and labeled, first during accumulation of the waste and before the waste is moved from the WAG site.

3.2 Packaging

3.2.1 Available Containers

When CERCLA remediation wastes are shipped from various WAGs to the ICDF Complex, the waste generator will be required to ensure that the wastes are packaged in accordance with the SSSTF WAC. The six containers evaluated in this EDF are U.S. Department of Transportation (DOT)-approved containers and commonly used at the INEEL. These containers are described below:

55-Gal Steel Drum. Strong tight/IP-1 open head drum with a capacity of 0.27 yd^3.

INEEL Wooden Boxes. Strong tight/IP-1 2 × 4 × 8 ft and 4 × 4 × 8 ft boxes have capacities of 2.3 yd^3 and 4.2 yd^3, respectively.

Super Sacks. Strong tight/IP-1 (96 x 88 x 60 in.) LL-88 soft-sided bag with a capacity of 10.9 yd^3.

Dump Truck. Strong tight/IP-1 covered dump truck with capacity of 15 yd^3.

Roll-Off Containers. Strong tight/IP-1 roll-off containers have a capacity of 20 yd^3. They are generally open topped and are either closed with the use of tarp assembly or a rigid lid composed either of aluminum or fiberglass.

3.2.2 Container Compatibility

Not all wastes are compatible with every type of container. Some acids will destroy metal drums, and some organic solvents will dissolve plastic containers. As no universal container can be used for transportation at the INEEL (40 CFR 300.5)[6] or for the storage of all hazardous materials, it is critical that compatible containers be identified whenever a new waste stream is generated or when any changes are made to an existing waste stream.

3.2.3 Container Costs and Useful Capacities

The Table 2 summarizes the cost for each of the containers and their useful capacities. The 55-gal drum is capable of being filled to capacity. The useful capacities of the wooden boxes and supersacks are based on 80% of the full capacity to allow for a safety factor in maintaining the structural integrity of the containers. The dump truck's and the roll-off container's useful capacities are based on standard DOT vehicle weight restrictions for each using a basis of 120 lb/ft^3 soil density. The 120 lb/ft^3 is a conservative average of the density of the materials to be received for stabilization.

Table 2.

Container	Cost	Full Capacity (yd^3)	Useful Capacity (yd^3)
55-Gal Drum	$32.50	0.27	0.27
Wooden Box (2 x 4 x 8 ft)	$550	2.3	1.9
Wooden Box (4 x 4 x 8 ft)	$700	4.2	3.4
Supersack (96 x 88 x 60 in)	$400	10.9	8.7
Dump Truck[a]	$80,000	15	11
Roll-off with tarp	$4,500	20	13

a. The dump truck is considered as both a container and mode of transportation for the purpose of this EDF.

4. TRANSPORTATION/SHIPPING EVALUATION

All waste transported on public roadways (e.g., between Test Area North and the SSSTF; and between the Radioactive Waste Management Complex [RWMC] and the SSSTF) shall be shipped in compliance with applicable DOT regulations, the manifesting requirements in 40 CFR Part 262, Subpart B[8] and the pre-transport marking requirements in Section 262.32(b). When applicable, a February 12, 1997, Federal Register (62 FR 6622)[7] rule change allows for non-manifested waste to be transported along the border of continuous property; under the control of the same person, even if such contiguous property is divided by a public or private right-of-way [Section 262.20(f)]. Procedures for shipping will be developed prior to operation.

Table 3 lists the mode of transport that will be used for each container type along with their costs and weight capacities.

Table 3.

Container	Mode of Transport	Cost of Transport	Weight Capacity of Truck Including Containers (lbs)
55 Gallon Drum	Tractor with Trailer	$145,000	50,000
Wooden Box (2 x 4 x 8 ft)	Tractor with Trailer	$145,000	50,000
Wooden Box (4 x 4 x 8 ft)	Tractor with Trailer	$145,000	50,000
Supersack (96 x 88 x 60 in)	Tractor with Trailer	$145,000	50,000
Dump Truck	N/A	$80,000	34,000
Roll-off with tarp	Truck with Hook Hoist	$95,000	42,000

4.1 Transport Route

Existing INEEL roads will be used to transport wastes from WAG sites to the SSSTF. See Appendix A for transport routes. All waste transport routes have been designed and constructed in accordance with the Federal Highway Administration (FHWA) and the Idaho Transportation Department (ITD) regulations. Therefore, all routes are adequate for the transportation of legal load waste shipments.

5. EVALUATION OF CONTAINERS

Table 4 illustrates the cost evaluation process. It lists the number of containers or loads for each waste stream by container type and the total costs for each packaging and transport option. The method of comparison for the table was determined by the following basis:

- The total number of containers or loads was calculated by the total waste stream volume divided by the useful capacity of each container type.
- The total costs were calculated by multiplying the cost of the container by the total number of containers needed and then adding the cost of the mode of transport.
- The cost of the mode of transport was distributed throughout the life cycle of the scheduled stabilization and weighed against the ratio of containers per waste stream over the total containers per specific container type.
- The cost of using each container type includes four vehicles to transport the containers. For the purpose of this EDF four vehicles were assumed to be adequate to maintain process flow rates.
- A shipping rate was assumed approximately equal to the stabilization-processing rate. This rate is further discussed in "SSSTF/ICDF Operational Scenario and Process Flows," EDF 1547.[9] The number of reusable containers necessary was calculated assuming the staging for treatment area was filled.

Table 4.

			Packaging Options					
			1	2	3	4	5	6
			55-gal Open Head Drum	2 x 4 x 8 ft Wooden Box	4x4x8 ft Wooden Box	96 x 88 x 60 in. LL-88 Softsided Bag (supersack)	Covered Dump Truck	Roll Off Containers
Waste Stream	Classification	Year	Number of Containers or Loads and Total Costs					
WAG-4 – CFA-04 Material Volume: 800 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2001	2963	422	239	92	73	62
			$110,000	$245,300	$180,800	$50,500	$10,600	$13,300
WAG-10 – BORAX-1 Material Volume: 11,110 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2003	41149	5860	3307	1275	1010	855
			$1,526,800	$3,406,200	$2,500,500	$699,400	$145,600	$182,900
WAG-5 – ARA-12 Material Volume: 1,000 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2004	3704	528	298	115	91	77
			$137,500	$306,900	$225,400	$63,100	$13,200	$16,500
WAG-3 - CPP- 92 Material Volume: 1,370 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2004		584	64			
				$18,300	$3,600			
WAG-1 – WRRTF-1 Material Volume: 20,070 d^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2004	74334	10586	5974	2302	1825	1544
			$2,758,100	$6,153,200	$4,517,000	$1,262,800	$263,000	$330,200
WAG-5 - ARA-25 Material Volume: 36 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2004	134	19	11	5	4	3
			$5,000	$11,100	$8,400	$2,800	$600	$700
WAG-3 - CPP- 98 Material Volume: 250 yd^3	DOT proper shipping name: This material is not regulated by DOT. There is no proper shipping name.	2004		17	101			
				$600	$5,700			
WAG-3 - CPP- 99 Material Volume: 126 yd^3	DOT proper shipping name: This material is not regulated by DOT. There is no proper shipping name.	2004		15	44			
				$500	$2,500			
WAG-5 - ARA-12 Material Volume: 966 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2005	3578	510	288	111	88	75
			$132,800	$296,500	$217,800	$60,900	$12,700	$16,100
WAG-5 - ARA-25 Material Volume: 36 yd^3	DOT proper shipping name: "Radioactive material, LSA, n.o.s..."	2005	134	19	11	5	4	3
			$5,000	$11,100	$8,400	$2,800	$600	$700
		TOTAL COSTS	**$4,675,200**	**$10,449,700**	**$7,670,100**	**$2,142,300**	**$446,300**	**$560,400**

a. These are already containerized per EDF #1.

- The decision to buy or lease the vehicles was not evaluated in this EDF process. Since each container type will utilize four vehicles, the cost would be distributed evenly throughout the container types whether the vehicles are bought or leased. Therefore, for the cost evaluation, it was simpler to add the cost of each vehicle than to project leasing costs throughout the life of the facility.

- The dump trucks are evaluated as a container and mode of transport combined, but includes the use of roll-off containers for staging at the SSSTF because of the possible need to stage the waste before or after stabilization.

- The cost determinations for the various containers in waste streams WAG-3 CPP-92, CPP-98, and CPP–99 (highlighted in Table 4) were not made because they are pre-boxed and will not be repackaged for transport. The costs for these streams are based on the cost of the mode of transport only.

- It was assumed that the 55-gal drums, the wooden boxes and supersacks are a one-time use only and will be disposed of in the landfill. The dump trucks and roll-off containers will not be disposed of in the landfill and will be reused.

The cost of containers and mode of transportation were then incorporated into the following decision matrix in order to determine the best way to containerize and transport the waste. The matrix brings the following criteria into consideration:

- Worker radiation exposure – ranked 1 to 10, where 10 is the least radiation exposure

- Contamination control – ranked 1 to 10, where 10 is the best for contamination control

- Labor intensive – ranked 1 to 10, where 10 is the least labor intensive

- Cost – ranked 1 to 10, where 10 is the least expensive

- Ease of disposal of waste containers– ranked 1 to 10, where 10 is the easiest waste container to dispose of

- Staging – ranked 1 to 10, where 10 is the easiest container to stage.

By definition, the worst alternative was always ranked a 1, and the best a 10, with all other container types determined at or in between these values. Each container type was then totaled and the container type with the highest amount was the best for the project. Table 5 illustrates the decision matrix.

For worker radiation exposure, the 55-gal drum was ranked 1 because it requires more hands-on operation to fill and empty the container, i.e., shovels, bands with bolts, etc. The dump truck and roll-off containers were ranked 10 because the equipment required to fill and empty these containers are more remote for the operator, i.e., backhoe, dump truck, and roll-off hoist.

Regarding contamination control, the dump truck was ranked 1 because of its inherit openness and the necessity to use heavy equipment that creates more dust problems, loss of material through tailgates, etc. The 55-gal drum was ranked 10 because it's easier to control dust by using hand shovels.

As for labor intensity, the high and low were just the opposite as the contamination control for the same reasons. It's easier to fill a dump truck with a backhoe than to fill numerous 55-gal drums by hand with shovels.

The costs are shown in Table 4.

For the ease of disposal of waste containers, the 55-gal drums were ranked 1 because of the large amount of containers that are required to move the waste, can-crushing operations, landfill space required, etc. The dump trucks and roll-off containers were ranked 10 because they require the least amount of containers necessary to move the waste and require no landfill space.

And, finally, the staging was ranked having the dump trucks as 1 due to the inherent difficulties of staging waste for longer periods of time (hours to 2 days) in dump trucks. The roll-off containers were ranked as 10 because they can hold large volumes of waste with the minimum amount of containers.

Table 5.

Categories	55-gallon Drum	2x4x8 Wooden Box	4x4x8 Wooden Box	Supersack	Covered Dump Truck	Roll-off Container
Worker Radiation Exposure	1	5	6	4	10	10
Contamination Control	10	7	7	3	1	3
Labor Intensity	1	5	7	3	10	10
Cost	5	1	3	7	10	9
Ease of Disposal of Waste Containers	1	7	7	4	10	10
Staging	3	5	6	5	1	10
Totals	21	30	36	26	42	52

6. RECOMMENDATION OF WASTE TRANSPORTATION

Based on the decision matrix, it is recommended that the best way to transport the waste from each WAG to the SSSTF is using the roll-off containers; with the exception of waste streams CPP-92, CPP-98, and CPP-99, which are already in boxes.

7. CONCLUSION

The purpose of this EDF is to evaluate the method(s) of efficiently transporting CERCLA remediation wastes from the various INEEL WAG sites to the INEEL ICDF Complex. This EDF includes the decision criteria for selecting the preferred method or methods of transport. Six container types were evaluated:

- 55-gal drums
- 2 x 4 x 8 ft wooden boxes
- 4 x 4 x 8 ft wooden boxes

- Supersacks
- Dump trucks
- Roll-off containers.

Each container type was evaluated against six criteria and ranked from 1 to 10, 10 being the best for the criteria. The six criteria were:

- Worker Radiation Exposure
- Contamination Control
- Labor Intensity
- Cost
- Ease of Disposal of Waste Containers
- Staging.

Each container type was then tallied and the highest valued container was considered the best container for the purpose of transportation. With the value of 52, the results from Table 5 concluded that the roll-off container is the container of choice, with the exception of waste streams CPP-92, CPP-98, and CPP–99, which are already packaged in wooden boxes.

8. REFERENCES

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6. 40 CFR 300.5, *National Oil and Hazardous Substances Pollution Contingency Plan.*

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8. 40 CFR Part 262, Subpart B, Protection of Environment, Resource Conservation Recovery Act.

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